SIEMENS

MAMMOMAT Novation

SP

Maintenance Instructions

System

Maintenance Instructions

The protocol SPB7-250.832.01.02.02 is required for these instructions

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The document corresponds to the version/revision level effective at the time of system delivery. Revisions to hardcopy documentation are not automatically distributed.

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1 General information

1.1 Training

- Self-instruction package or training workshop and at least 1 installation

1.2 Required documents

- Planning Guide SPB7-250.891...
- Wiring diagrams SPB7-250.844...
- Installation and Start-up Instructions SPB7-250.812...
- Software SPB7-250.816...
- Maintenance protocol SPB7-250.832...
- Instructions for use SPB7-250.201...
- Quality Control Manual SPB7-250.210...

1.3 Required tools, measurement and auxiliary devices

Auxiliary Materials

NOTE	**Calibrated instruments are required.**

Item	Remarks	Material Number	With System
Oscilloscope >50MHz with memory	e.g. TEKTRONIK 314		no
Digital multimeter including a mAs meter	e.g. FLUKE 8060A or FLUKE 87	97 02 101 97 03 976	no
Service PC	See the CS Intranet for details **CS/For Service/Common Service Laptop for CSE's**		no
Power Line Impedance Meter		84 28 104	no
Power ground-wire tester		44 15 899	no
Luminance meter (for monitor calibration)	e.g. Mavo monitor or Wellhöfer LX plus (05 146 167)	97 02 432	no
Luminance meter (measures the light intensity from the X-ray field)	e.g. SMfit Mammo	88 81 281	no
Dose Meter	e.g. Solidos	88 81 323	no
Ion chamber	For dose meter Solidos	88 81 315	no
Densitometer	e.g. X-Rite 331	97 02 416	no
A non-invasive digital kV meter	If not available in the district office, a scope can be used instead		no

Phantoms / Auxiliary

Item	Remarks	Material Number	With System
RMI 156		88 81 265	no
Three, 2 cm plexi (PMMA)		65 61 232	yes
2 mm steel plate, 30x25 cm		66 55 851	yes
2 mm steel plate, 3x10 cm		66 55 844	yes

Item	Remarks	Material Number	With System
One 0.1 mm, two 0.2 mm and one 0.5 mm sheets of aluminum 99% (1100) alloy, 4x4 cm		88 81 273	no
Mammography line pair phantom	2-10 lm/mm	88 81 299	no
Collimator mounted plexi (4cm)			yes
Compression plate simulator			yes
4.2 cm plexi	Size of the detector	74 47 720	no
Ethernet cable			no
Serial PC cable	RS232 / Array / BRICK	66 55 745	yes
Serial PC cable	RS232 / Stand	99 00 440	no
Cassette / Film 24x30 cm			no
Centering cross		96 60 051	no

⚠WARNING

The existing ground conductor in the mains cable must under no circumstances be disconnected when operating the oscilloscope.

A lethal electric shock hazard exists.

➪ **For those measurements in which any resulting ground loop may falsify the measuring result, use the differential amplifier (difference measurement).**

Tools

Item	Remarks
Standard installation and service tools	
Torque wrench for bolting the stand/console to the floor	
Electrical screwdriver with adjustabe torque is recommended	

1.4 Required lubricants

- All purpose grease PD2
- Viscogen oil

1.5 Text emphasis

⚠ DANGER	**DANGER indicates an immediate danger that may lead to death or serious physical injury.** ➪ **n.a.**
⚠WARNING	**WARNING indicates a risk of danger that may lead to death or serious physical injury.** ➪ **n.a.**
⚠CAUTION	**CAUTION used with the safety alert symbol indicates a risk of danger that may lead to slight or moderate physical injury and/or damage to property.** ➪ **n.a.**
NOTICE	**NOTICE used without the safety alert symbol indicates a risk of danger that, if disregarded, may cause a situation leading to an undesirable result or state other than death, physical injury or damage to property.** ➪ **n.a.**
NOTE	**NOTE contains information provided with special emphasis to facilitate proper use of the equipment or proper execution of a procedure, i.e. hints, tips.**

1.6 Safety Information and Preventive Measures

⚠CAUTION

When completing repair work and tests, please note:
the product-specific safety information in the document,
the safety information in TD00-000.860.01... as well as
the safety information contained in the TI folder in Register 2.

➪ **Tests or ajdustments that must be made with radiation switched on are identified with the radiation warning symbol. During these types of adjustments, radiation protective clothing must be worn.**

1.7 Explanation of abbreviations

Abbrev.	Explanation
SI	Safety inspection
SIE	Electrical safety inspection
SIM	Mechanical safety inspection
PM	Preventive maintenance
PMP	Preventive maintenance parts replacement, external inspection, etc.
PMA	Preventive maintenance adjustments
PMF	Preventive maintenance, function check, operating value check
Q	Quality check
QIQ	Image quality check
QSQ	System Quality Check
SW	Software Maintenance
CSE	Customer service engineer
CS No.	Customer-specific number
IVK	Installed volume components
WE	Maintenance unit

1.8 Symbols

Checks and adjustments that must be performed with radiation ON are identified by the radiation warning symbol.

2 System

2.1 Checks

PMP Radiation protection

- Check the radiation protection shield for possible damage (1/Fig. 1 / p. 13).
- Information regarding the lead equivalent value must be legible.

PMP Face shield and compression plate

- Check the face shield and compression plate for correct seating and for damage (2/Fig. 1 / p. 13).

SIM Level

- Verify that the system is leveled with respect to the floor. Check the leveling screws (3/Fig. 1 / p. 13)with a water level and, if available, the floor mounting (optional).

SIM Swivel arm attachment

- Check the swivel arm attachment by pulling on both support rails (minimum play of approximately 2° is correct). (4/Fig. 1 / p. 13).

SIM Basic table

- Check the mounting of the basic table as well as the locking mechanism for the exposure system (5/Fig. 1 / p. 13).

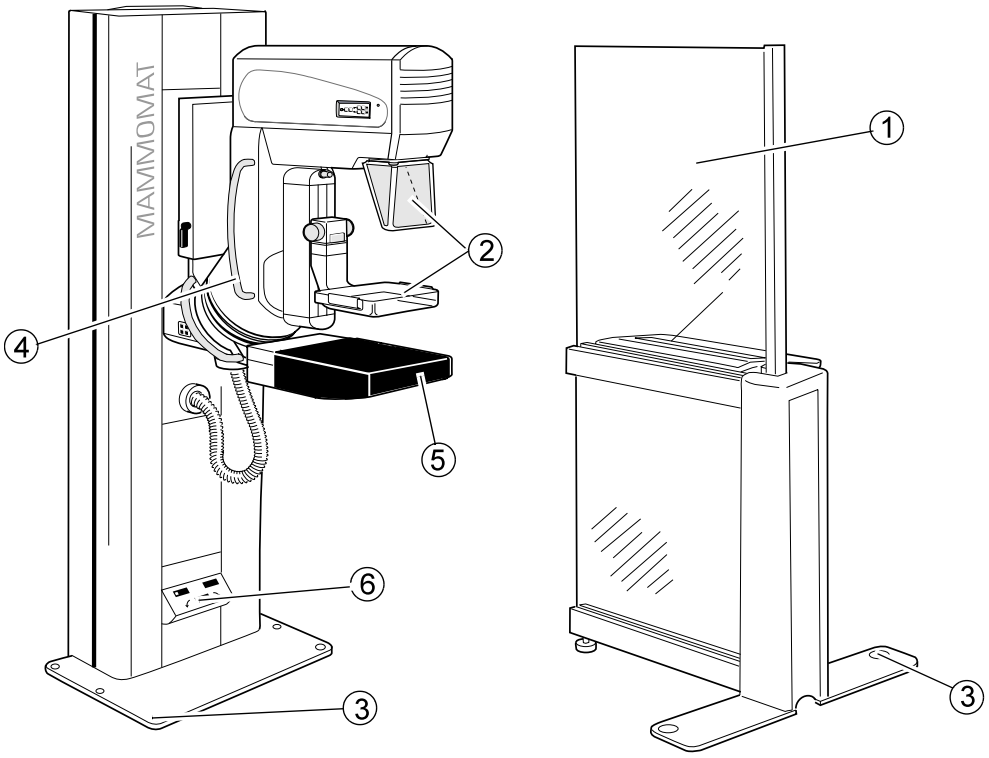

Fig. 1: MAMMOMAT Checks

2.2 Preparations

SIE **Cables**

- System OFF
- Check the condition of the cables and the corrugated tubing (3/Fig. 2 / p. 14)while removing the following covers:
  - X-ray tube covers (left, right and front) (1, 2/Fig. 2 / p. 14)
  - all covers of the stand (3, 6/Fig. 3 / p. 14)

⚠WARNING **The edges of the metal curtain are very sharp and may cause severe injury.**

➪ **Attach the protective strips.**

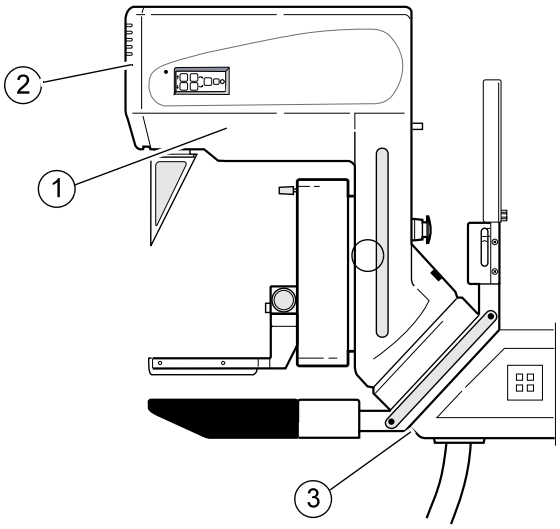

Fig. 2: X-ray tube covers

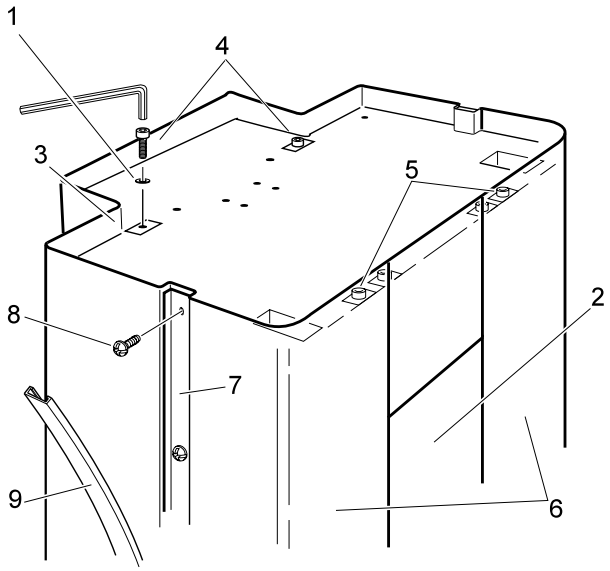

Fig. 3: Covers

3 Column stand

NOTE

To gain access to the rear of the column stand you have to swivel the generator.

3.1 Checks

SIM Steel ropes

- Do the steel ropes (balancing and flap), the drive belt, the suspension or the pulleys show any damage (e.g. fraying or splitting) or signs of wear?

PMA Oil and grease

- If they are okay, lightly oil the wire cable and grease the rails, then remove the protective strips.

SIE Limit switches

- System ON. Move the lifting carriage up and down several times, the lifting carriage should be in an upright (0°) position.

NOTE

It is normal to hear some noise caused by the rotation of the radiation filter in the collimator when switching the system ON.

- Do the limit switches stop the carriage travel at the top and at the bottom?
- Activate safety switch S882. System movements must be blocked.

PMF Vertical travel

- Is the vertical travel smooth and noiseless?
- Switch the system OFF and attach the protective strips once again.

SIM Safety catch and rotation safety catch

- Do the safety catch (1/Fig. 4 / p. 16) and rotation safety catch (2/Fig. 4 / p. 16)show any visible damage? Are the springs in good condition?

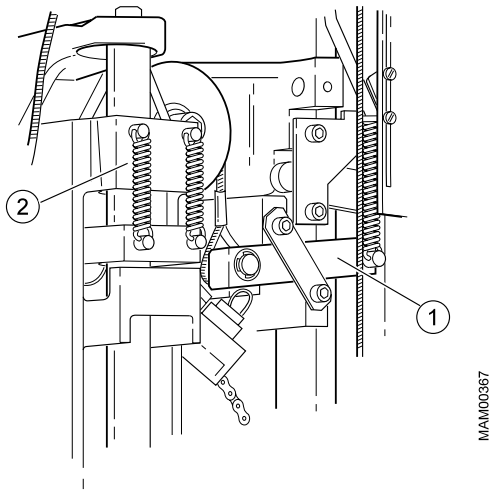

Fig. 4: Catch

SIM Ball bearings

- The lifting carriage is equipped with ten or twelve ball bearings (refer to (Fig. 5 / p. 17)). Check that all ball bearings are in place and that they show no signs of damage.

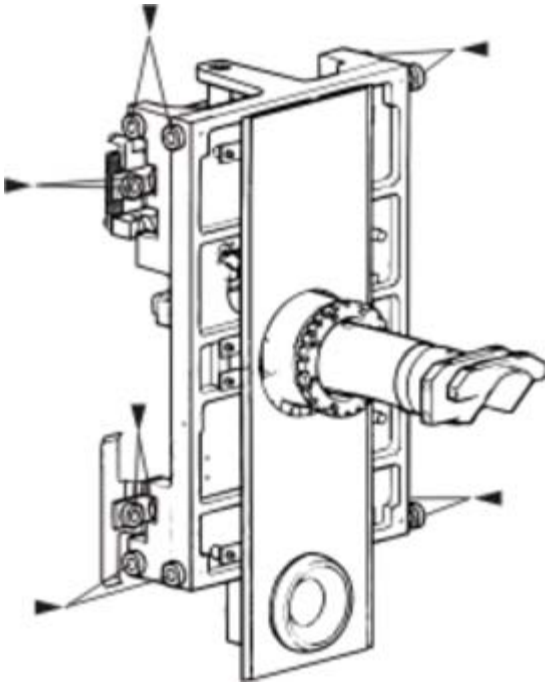

Fig. 5: Ball bearings

SIM Mounting for the X-ray tube

- Check the mounting for the X-ray tube unit (1/Fig. 6 / p. 17).

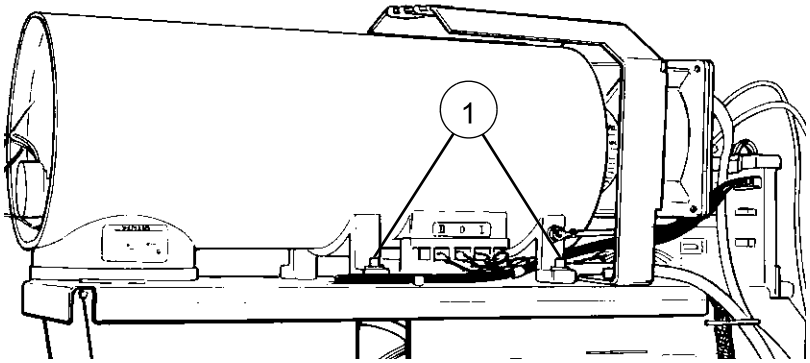

Fig. 6: X-ray tube

PMA Grease the grid spindle

- Remove the cover plate from the object table and lightly grease the grid spindle. Reattach the cover plate.

4 Compression and system movements

4.1 Testing the “compression” function

- Attach the spring scale as shown in (1/Fig. 1 / p. 18) and make sure not to damage the compression plate during the following tests:

  Tolerance: ± 1 kp.

4.1.1 Compression cutoff

- System ON

PMF Presetting

- Select any value (e.g. 6 kp) on the potentiometer (2/Fig. 1 / p. 18) and compress. Does the compression unit cut off at that setting?

SIE Max. value for cutoff

- Select the maximum value (20 kp) with the potentiometer (2/Fig. 1 / p. 18). (20 kp). Does the unit cut off when it reaches the maximum value?
- Correct display (chapter 2 "System", (6/Fig. 1 / p. 13)).

PMF OPCOMP

- Position your forearm between the object table and the compression plate and check the OPCOMP function.

  ➪ Typically, the cutoff value is between 6 and 10 kp with the factory setting.

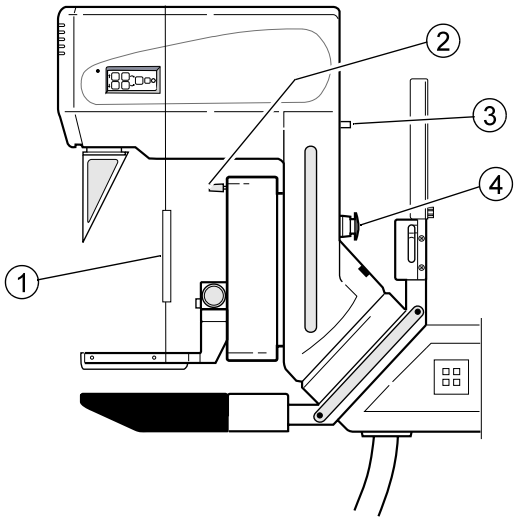

Fig. 1: Compression

4.2 Testing the “decompression” function

- Attach the spring scale as shown in (1/Fig. 2 / p. 20)Tolerance: ± 1 kp.

4.2.1 Decompression cutoff

SIE Safety switch

- Does the decompression cut off at approximately 5 kp counter pressure?
  - ➪ Due to the location of the measurement, this value corresponds to approximately 3 kp at the compression plate.

4.2.2 Travel

PMF Compression travel

- Move the compression plate up and down. Is the movement smooth and noiseless through the entire range?

4.2.3 Applying oil and grease

PMA Oil and grease the compression unit

- System OFF

  Remove the upper and lower covers.

  (snap closures, (2/Fig. 2 / p. 20)and pot knob (3/Fig. 2 / p. 20))
- After removing the "small" Allen screws (two above and two below), the right cover ((4/Fig. 2 / p. 20)) of the compression unit can be removed.
- Grease the rails ((2/Fig. 3 / p. 20)) lightly and check the belt ((1/Fig. 3 / p. 20)) and string ((3/Fig. 3 / p. 20)) for damage / wear as well as for tension.
- Reinstall the covers on the compression unit.

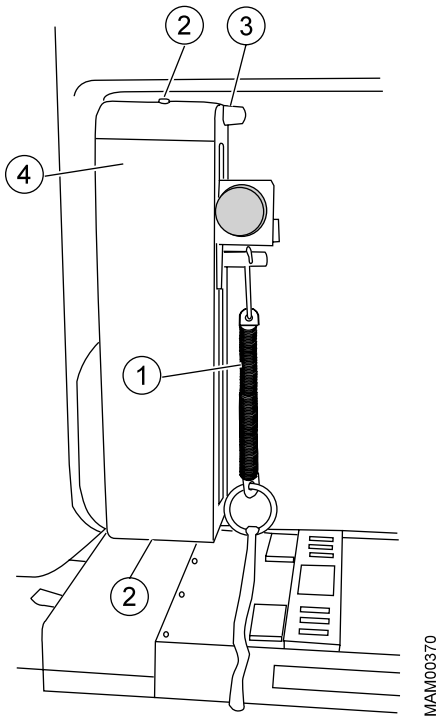

Fig. 2: Remove the right cover

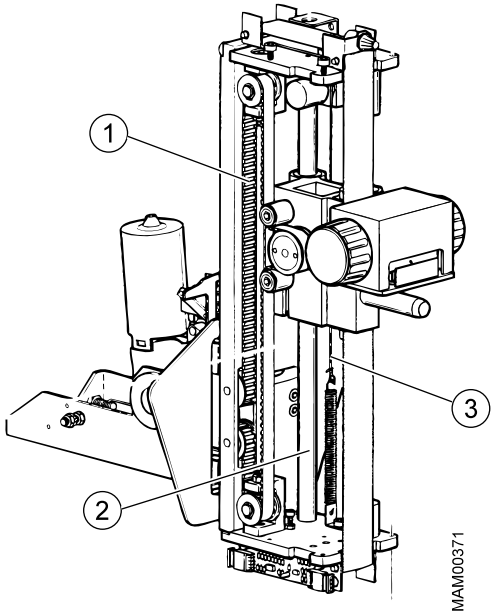

Fig. 3: Grease the rails

4.3 Compression thickness display

PMF Thickness indicator

- System ON. Move the compression plate to its full height and measure the height.
  - ➪ The value displayed (chapter 2 "System", (6/Fig. 1 / p. 13)) must agree with the value measured.

4.4 Checking miscellaneous system movements

SIE Rotation cutoff

- Check whether the motorized rotation movements cut off when a preset angle is reached. The angle (e.g. 90°) is preset with the potentiometer, (3/Fig. 1 / p. 18).
- Check the automatic cutoff function when passing the 0° position as well.

PMF Rotation movements

- Is the rotation smooth and noiseless through the entire range?
- Is the display correct (chapter 2 "System", (6/Fig. 1 / p. 13))?

SIM Blocking the rotation and vertical travel

- Rotation and vertical travel must be blocked at a compression force of > 3 kp.

5 Test exposures

- Test the kV/mA control loop according to Installation & Start-Up instructions, chapter "Checks with high voltage".

5.1 Evaluating test values

PMF Anode acceleration

- Listen to the sound generated by the accelerating anode. Is the sound normal?

PMF kV and mA

- Do the measured kV and mA values agree with the values selected?

PMF mAs selection

- Do the measured mAs values agree with the values selected?

PMF mAs value displayed

- Does the mAs value measured agree with the mAs value displayed (for AEC)?

PMF Grid voltage

- Attach the magnification table. Measure the grid voltage (small focus) on tube test point G against test point H_3. Does the value measured agree with the value in the test protocol?
- Test both focal spots (if available).

PMF Signal lamp

- Does the radiation-ON indicator light up?

PMF Chest wall missed tissue

- Perform the check according to the Quality Control Manual, chapter "Chest wall missed tissue", to ensure that the chest wall missed tissue is within the tolerance of max. 5 mm.

PMF Spatial resolution

- Perform the check according to the Quality Control Manual, chapter "Spatial resolution", to ensure that a sufficient spatial resolution is obtained with the system.

PMF Mean glandular dose

- Perform the check according to the Quality Control Manual, chapter "Mean glandular dose, to ensure that the mean glandular doses are according to regulations.

5.2 BIAS voltage check

PMF The BIAS voltage settings shall be checked.

Required equipment

Voltmeter with sharp probes, a small screwdriver, a compression plate simulator, and a magnification table.

Required documents

Calibration data for the x-ray tube (found on a note called “prüfprotokoll” in the MAMMOMAT Novation^{DR} Technical Manual).

Procedure

- Turn ON the main power supply to switch the detector ON. Allow a detector warm-up time of 1 hour.

  The detector should be powered on at least 1 hour before intended use. If it is used sooner than 1 hour after being powered on, image quality can be affected.
- Press button ⧈ on the control panel to turn the MAMMOMAT ON. Allow a warm-up time of approximately 5 minutes. The internal monitoring system automatically performs a functional check of the MAMMOMAT. “dr” is displayed on the film density display on the control panel to indicate that communication within the MAMMOMAT Novation^{DR} system is functioning.
- Attach a magnification table so that small focus is selected.

  It does not matter if a 1.5x or 1.8x magnification is selected.
- Mount a compression plate simulator.
- Select Mo anode on the control panel. Measure the voltage for the Mo anode at connector X726 on the tube power supply between pin 1 (BIAS_VOLTAGE) and pin 6 (0V). The measured voltage(s) must correspond to (tolerance + 1V) the calibration data for the X-ray tube. If this is not the case, adjust the "Bias Mo" potentiometer until the voltage corresponds to the calibration data (tolerance + 1V).
- Perform the same procedure as in step^{2} with W and adjust the "Bias W" potentiometer.

5.3 Testing dose rate control

PMF

- Cover the measurement field (e.g.with a lead apron) and release an exposure.

Dose rate control

- Does the dose rate control switch the exposure off after approximately 100 ms?

5.4 Testing the radiation field/ light field

- Proceed with the test according to the Installation & Start-Up instructions, chapter "Collimator Adjustment".

PMF **Collimator check**

- Is the collimator adjusted correctly?

6 Miscellaneous

6.1 Blocking exposure release

PMF Blocking

Exposure release must be blocked under the following conditions (indicated on the control console):

- No patient is registered.
- No compression plate is mounted.
- The wing is not in position.

6.2 Checks

SIE Emergency STOP

- Press Emergency STOP, see chapter "Compression and system movements" (4/Fig. 1 / p. 18).
  - Are compression, rotation and vertical travel of lifting carriage blocked?
- Release Emergency STOP.

PMF Indicators

- Check the LEDs on the operating console by starting the Panel Test via the service PC.

PMP Error memory

- Read out the error memory and the exposure counter with the service PC.

PMP Record error memory

PMP Delete the error memory

- Enter the data of the exposure counter and the error memory in the protocol and delete the error memory o n l y.

PMF Auxiliary voltages

- With the voltmeter, measure the auxiliary voltages according to circuit diagram (SPB7-250.844...).
- System OFF

PMF OPDOSE

- Check the selection of various anodes / filter combinations and OPDOSE according to the Installation Start-Up instructions, chapter "Testing and adjusting the OPDOSE".

PMA UIs and SPEED Infos

- Check whether all relevant UIs and SPEED Infos have been completed.

6.3 Quality

Proceed with the test according to the Quality Control Manual.

Q **Monitor check and viewing conditions**

- Perform the check according to the Quality Control Manual, chapter "Monitor check and viewing conditions", to assess the quality of the acquisition workstation monitor.

Q **Printer check**

- Perform this check according to the Quality Control Manual, chapter "Printer check", to assess the quality of the printer.

QIQ **Phantom image quality check**

- Perform the image quality check according to the Quality Control Manual, chapter "Phantom image quality".

QIQ **Detector uniformity**

- Perform the image quality check according to the Quality Control Manual, chapter "Detector uniformity", to ensure that the pixel values of the detector do not deviate more than 5% from each other.

QIQ **Beam quality (HVL)**

- Perform the image quality check according to the Quality Control Manual, chapter "Beam quality", to optimize the dose calculation

QIQ **AEC image stability, repro and signal-to-noise (SNR)**

- Perform the check according to the Quality Control Manual, chapter "AEC image stability, repro and signal-to-noise (SNR)", to assure, that the coefficient of variation for the entrance dose and mAs is less than 0.05 and the SNR does not vary more than ± 15% from the mean value.

QIQ **Ghost image evaluation**

- Perform the check according to the Quality Control Manual, chapter "Ghost image evaluation", to ensure that the ghosting is within an acceptable level.

6.4 Final tests

- Remove the measurement devices.

PMF Operating problems

- Were there any operating problems during the checks?

PMP Covers

- Remove protective strips and attach all removed covers. Check that all covers are complete and firmly seated, including the cable duct.

SIE Protective conductor test

- Perform the protective conductor test according to ARTD-002.731.17....

PMP Cleaning / Damaged paint

- Clean the unit using the materials recommended in the Instructions for use and repair any damaged paint.
- System ON.

QSQ Final test exposure

- Take one final test exposure.